

Keystone Ferry Terminal Study

Environmental Considerations

Prepared for



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ATTACHMENT

1 Environmental Considerations Table

Keystone Ferry Terminal Study: Environmental Considerations

This memorandum considers the environmental effects of seven vessel/harbor options for the Keystone Ferry Terminal. Figures showing the various vessel/harbor options are presented in Appendix 4. The analysis focused on four elements of the environment due to the limited time frame for the analysis. The following four elements were selected because they were most likely of all the elements of the environment (per National Environmental Policy Act [NEPA] and State Environmental Policy Act [SEPA]) to be affected by the vessel/harbor options and thus help to differentiate between the options:

- Parks and Recreation
- Historic and Cultural Resources
- Aquatic Resources
- Surface and Groundwater Resources

To meet the short time frame, a screening-level analysis was conducted. In other words, the analysis is based on existing available information and on a limited site reconnaissance; no in-depth fieldwork such as sampling, drilling, or surveys were conducted.

The following presents the environmental analysis by each element. Each discussion describes the methodology and screening criteria used to evaluate potential effects and highlights the key findings. The table in Attachment 1 identifies by individual screening criteria the effects of each vessel/harbor sub-option.

Parks and Recreation

Fort Casey State Park surrounds the Keystone Harbor. To the east of the jetty is the Keystone Conservation Area, which is also referred to as the Fort Casey Underwater Park.

Methodology

To assess the effects on Fort Casey State Park and Keystone Conservation Area, the following factors were evaluated:

Area of acquisition – the acreage that would be needed to accommodate each vessel/harbor sub-option. This includes both the area that would need to be dredged as well as the footprint of the terminal and vehicle holding area.

Specific facilities affected – the number of facilities that would be displaced. Potentially affected facilities include campsites, boat launch and associated trailer parking, and dive area parking, staging area and proximity to jetty.

Other effects – this criteria takes into account that all property acquisition may not lead to the total displacement of facilities, but rather some facilities could be relocated, temporarily closed, or more difficult to access.

Results

Area of Acquisition

Fort Casey State Park: A small portion, 0.4 acre, of the park southwest of the existing holding area would be needed to expand holding area under Options 1 and 6 as well as sub-options SE-2, KS-2, and NP-2. These options and sub-options would not require acquisition of any portion of the campground area.

Like the other Option 2 sub-options, 130-2 and 100-2 would require acquisitions of 0.4 acre of Fort Casey State Park southwest of the existing holding area. In addition, sub-options 130-2 and 100-2, would need 2.2 acres of the campground to dredge a widened channel. As a result these sub-options would require a total of 2.6 acres from the park.

For Option 3, 3.3 acres within the boat launch/trailer parking area would be acquired.

All of the Option 4 sub-options except SE-4 would require acquisition of 6.6 acres: 1.3 acres of the existing campground to widen the harbor channel and 5.3 acres to the northeast of the harbor, including portions of the boat launch parking area and an undeveloped area farther east. SE-4 would not require acquisition of any portion of the campground area, but would require the same 5.3 acres as the other sub-options.

Under Option 5, WSF would need to acquire 5.1 acres of the existing campground area.

Option 7 would require the acquisition of 2.0 acres: 1.6 acres in the vicinity of the boat launch and the associated parking area and 0.4 acre to the southwest of the existing holding area.

Keystone Conservation Area: Options 1, 2, 4, 5 and 6 would not require acquisition. Option 3 would require 0.8 acre of acquisition to accommodate terminal footprint. Option 7 would require 0.4 acre for dredging.

Area of Acquisition Summary:

- Moderate to High: Sub-options 130-4, 100-4, KS-4, and NP-4 (6.6 acres); sub-option SE-4 (5.3 acres); Option 5 (5.1 acres); and Option 3 (4.1 acres)
- Moderate: Sub-options 130-2 and 100-2 (2.6 acres); and Option 7 (2.4 acres)
- Low: Options 1 and 6 and sub-options SE-2, KS-2, NP-2 (0.4 acre)

Specific Facilities Affected

Option 1 and sub-options SE-2, KS-2, NP-2, SE-6, and KS-6 would not affect any facilities.

Property acquisition for sub-options 130-2 and 100-2 would displace 9 campground sites.

Option 3 would not displace any campground sites but it would displace boat launch and trailer parking. These facilities would be relocated to the existing terminal area.

Under Option 4 approximately 20 percent of the boat launch parking area would be displaced; the boat launch and associated parking would be relocated to the area currently occupied by the Keystone ferry terminal. The relocation of these facilities would consolidate camping and boating activities, lessening conflicts with ferry operations. All of the Option 4

sub-options except SE-4 and KS-4 would also result in the displacement of 4 campground sites.

Option 5 would displace at least 24 campsites; the remaining 11 sites may become inaccessible. Access to the trails to and from the campground would become more difficult.

Sub-options 130-6, 100-6, and NP-6 would result in the loss of beach along the campground and possible relocation of the boat launch depending on the extent of the sheet pile wall on the east side of the harbor.

For Option 7, the boat launch would be displaced and relocated farther east along the dredged area. The southeast half of the trailer parking area would be removed along with up to 6 picnic tables.

Special Facilities Affected Summary:

- High: Option 5 (displacement of at least 24 campsites and impaired access to trails)
- Moderate: 130-2 and 100-2 (displacement of at least 9 campground sites); 130-6, 100-6, and NP-6 (loss of campground beach and possible relocation of boat launch); and Option 7 (displacement of boat launch/trailer parking and picnic tables)
- Low: 130-4, 100-4, and NP-4 (displacement of boat launch/trailer parking and at least 4 campground sites); SE-4 and KS-4 (displacement of boat launch/trailer parking); Option 3 (displacement and relocation of boat launch/trailer parking)
- Least: Option 1, SE-2, KS-2, NP-2, SE-6 and KS-6 (no facilities affected)

Other Effects

Fort Casey State Park: Options 1, 2, 6, and 7 would require minor relocation of the roadway into the campground. In addition, for sub-options 130-2 and 100-2 the east leg of the campground loop and restrooms would need to be relocated, possibly leading to the displacement of additional camp sites.

Options 3, 4, and 5 would allow the consolidation of camping, boating and other recreational activities by State Parks. Conflicts with these activities and ferry operations would diminish.

With the relocation of the east leg of the campground loop, sub-options 130-4, 100-4, and NP-4 may displace some campground sites. These sites would be in addition to the 4 identified under "Specific Facilities Affected."

The sheet pile wall included in sub-options 130-6, 100-6, and NP-6 may extend approximately 15 feet above the water line and with the dolphins would partially block the view from the harbor shoreline; however, the area behind the western sheet pile could be back-filled to expand the campground area.

Keystone Conservation Area: Option 1 no effects. During construction of all of the other options (2 through 7), the dive park would likely be closed for safety reasons.

Under Option 3, another access point and parking area for the Keystone Conservation Area would be needed east of the proposed holding area. This new location could make access to

the breakwater more circuitous from the upland dive staging area. Similarly, Option 4 also would make access to the dive park more difficult, and would need to be relocated, possibly along the water side of the proposed holding area.

Under Option 7, the existing breakwater would be removed and relocated approximately 300 feet to the east. Removal of the breakwater would eliminate an established dive feature, the flora and fauna on the jetty, and diminish the current dive experience. Similar underwater conditions would take 5 to 10 years to recreate at the relocated breakwater. Dive programs, classes and general use would be adversely affected during the recovery period.

Other Effects Summary for Fort Casey State Park and Keystone Conservation Area:

- Moderate to High: Option 7 (minor relocation of campground entrance, closure of dive park during construction, diminished dive park experience for 5 to 10 years).
- Moderate: 130-2 and 100-2 (minor relocation of the campground entrance road, closure of the dive park during construction, and relocation of the campground eastern loop and restrooms); 130-4, 100-4 and NP-4 (relocation of additional campsites and closure of dive park during construction), and Option 6 (closure of dive park during construction and diminished views).
- Low: SE-2, KS-2 and NP-2 (minor relocation of the campground entrance road, closure of the dive park during construction); Options 3, 5, and SE-4 and KS-4 (closure of dive park during construction, diminished access to dive park).
- Least: Option 1 (no effects).

Combined Results

All of the factors were considered equally. Options 5 and 7 and sub-options 130-2 and 100-2 would have moderate impacts based on property acquisitions, direct effects to specific facilities, and other changes resulting from the options. Even though Option 4 (130-4, 100-4, KS-4, and NP-4) would require the greatest amount of property acquisition, its effects on specific facilities was limited, resulting in low to moderate impacts. Option 6 had the same result, low to moderate impacts, for the opposite reasons: it did not require much property acquisition but it did directly effect some facilities and their use, such as obstructing scenic views. Option 3 had low impacts based on its low to moderate property acquisition and low effects on facilities. Option 1 and sub-options SE-2, KS-2, and NP-2 required little property acquisition and resulted in impacts limited to relocating the roadway into the campground and requiring closure of the dive park during construction.

Cultural and Historic Resources

Methodology and Assumptions

The cultural resources analysis for the Keystone Legislative Study considers three factors: presence/absence of known/recorded historic properties; volume (cubic meters) of sediment to be excavated; and surface area (acres) of presently undisturbed land that would be affected by the Project. The following discussion describes how these factors were

applied to analyze the seven harbor/vessel options and the assumptions made in applying those factors.

Presence/Absence of Known/Recorded Historic Properties

The presence or absence of known/recorded archaeological sites and/or historic buildings and structures (e.g., "Historic Properties" as defined by the National Historic Preservation Act) is the first screening criterion. There are many historic buildings and structures within Fort Casey State Park, but none of the harbor/vessel options and their respective sub-options include these buildings and structures within their footprints. While there are undoubtedly many known/recorded as well as undetected/unrecorded historic archaeological remains or deposits within Fort Casey State Park, there are no known/recorded archaeological sites within the footprints of the seven harbor/vessel options.

Because all of the harbor/vessel options lie within the Ebey's Landing National Historical Reserve, we did not include the Reserve in the Cultural and Historic Resources analysis because all of the harbor/vessel options would have similar effects to the Reserve and thus would not help to distinguish amongst and between them.

Volume of Sediment to be Excavated

As suggested above, undetected/unrecorded historic archaeological resources may be present within the footprints of the harbor/vessel options. Known/recorded prehistoric Native American archaeological sites along the edges of Crockett Lake suggest a high probability that other prehistoric archaeological resources may be located in the immediate vicinity. Available information suggests, therefore, that archaeological resources, both prehistoric Native American and historic Euro-American, may be buried beneath terrestrial and/or submerged sediments.

Since no subsurface exploratory archaeological testing has been conducted, there is presently no firm scientific data that indicates where such subsurface archaeological deposits might be located. Because it is logical to assume that mass excavation/grading or sediment dredging could encounter undetected/unrecorded archaeological resources, this analysis uses the volume of sediment (to be excavated) as a screening criterion. That is, the more grading or dredging conducted to construct the harbor/vessel options the greater possibility that subsurface archaeological resources may be encountered. Lack of grading or dredging mostly precludes the possibility of encountering archaeological resources during construction.

Surface Area Disturbance

The least important of the three screening criteria used is that of the surface area (in acres) of presently undisturbed land to be affected by construction. Archaeological remains, if present, may lie on the surface or, more likely, just below the surface. Available information suggests that much of the study area has received some past disturbance; conducting surface examination of the harbor/vessel options for the presence/absence of artifacts or other archaeological indicators may not provide a definitive measure of the relative archaeological sensitivity (potential) of the various alternatives and their options.

As with grading or dredging, it is similarly assumed that alternatives and options that disturb larger areas (acres) of presently undisturbed (more accurately, presently undeveloped) land have a greater potential to disturb surface and near-surface archaeological resources.

Other Factors

On a subjective basis, some consideration was given to the proximity of the alternatives and their options to the historic built environment of Fort Casey. That is, those vessel/harbor options that involve greater quantities of grading, dredging, and/or larger surface disturbance areas *and* that are also located in closer proximity to Fort Casey, may have relatively greater potential for encountering historic archaeological resources.

Results

The following summarizes how each vessel/harbor option performs relative to each factor for this cultural and historic resources analysis. Specific effects of each vessel/harbor option are presented in the table in Attachment 1.

Presence/Absence of Known/Recorded Historic Properties

Following a site reconnaissance and evaluation of the footprints of the harbor/vessel options, all of the options were judged to be equal in terms of this screening criterion.

Volume of Sediment to be Excavated

- Moderate: Option 7 involves dredging more than 179,700 cubic yards of sediment. Sub-options 130-4, 100-4, and NP-4 involve dredging almost 85,000 cubic yards of sediment. Sub-options 130-2 and 100-2 involve dredging almost 74,000 cubic yards of sediment.
- Low: Sub-options 130-6, 100-6, and NP-6 would require dredging approximately 14,100 cubic yards of sediment. Sub-options SE and KS of Options 4 and 6 involve dredging approximately 8,465 and 3,050 cubic yards of sediment, respectively.
- Least: Options 1, 3, and 5 and sub-options SE-2, KS-2, and NP-2 do not require dredging.

Surface Area Disturbance

- Moderate: Option 7 involves about 10.3 acres of surface disturbance. Sub-options 130-2 and 100-2 involve about 8.7 acres. Sub-options 130-4, 100-4, and NP-4 involve about 8.1 acres of surface disturbance.
- Low: Sub-options 130-6 and 100-6 involve about 1.1 acres of surface disturbance. The remaining Option 6 sub-options (SE, KS, and NP) would disturb approximately 0.2 acre of presently undisturbed land. Sub-options SE-4 and KS-4 would disturb approximately 0.5 acre.
- Least: Options 1, 3, and 5, and sub-options SE-2, KS-2, and NP-2 would not require disturbance of presently undisturbed (undeveloped) land.

Combined Results

Each of the four cultural resources criteria was given equal consideration in developing the overall assessment. The impacts of sub-options 130 and 100 of Options 2, 4, and 7, as well as sub-options NP-4 are considered moderately high to moderate due to the combined amount of disturbance from dredging and clearing. Option 5 impacts are considered moderate to moderately low. Options 3 and 6 and sub-options SE-2, KS-2, NP-2, SE-4 and KS-4 would disturb a much more limited area and would have low impacts. Option 1 would not effect any undisturbed areas.

Historic Properties

The existing conditions of the WSF facilities and operations on Fort Casey State Park (Park) and Ebey's Landing National Historical Reserve (Reserve) date from 1948 when the U.S. Army Corps of Engineers created Keystone Harbor and introduced the ferry operations into close proximity to the historic features of the Park. The WSF facilities and ferry operations pre-date the formation of the Reserve in 1978.

The existing WSF facilities are utilitarian in design and were constructed with little to no consideration to the now-recognized "cultural landscape" protected by the Reserve nor with any consideration of its effects on the historic Fort Casey and its (1948) then-deteriorating condition of its lighthouse, artillery battlements, and other elements of the historic Fort Casey locale.

This screening analysis focused mostly on impacts to potential archaeological resources (prehistoric/Native American or historic/military). At this level of screening, knowing little about the architectural design of the new facilities (tollbooths, restrooms, public conveniences, ferry dock appurtenances, etc.), it is conceivable that larger facilities (designed for greater levels of public demand) would have a greater impact on the historic cultural landscape (Reserve) and on the overall quality of the public's enjoyment of the Park and its historic buildings, lighthouse, battlements, grounds, and setting. Demographically increased demand over the next few decades would ultimately require larger boats, larger auto holding areas, and larger public convenience facilities.

For any facilities at Keystone Harbor, an important issue will be a design that can minimize adverse effects on the historic cultural landscape and the historic values and overall public enjoyment of the historic setting of the Park. Some approaches might include:

- Construct buildings no higher than one-story to reduce visual intrusion into the rural/historic setting of the vicinity .
- Construct buildings that mimic either the concrete fortification theme of the Park battlements, or, that mimic the historic wood-frame buildings that characterize the surviving buildings within the Park. Alternatively, construction buildings that mimic the historic wood-frame agricultural buildings that characterize the 19th century farmsteads of the Reserve.
- Design auto holding areas that blend into the landscape by aggressive use of vegetative and rustic wood fence screening devices (to shield sensitive close-in viewsheds).

- Construct ferry terminal facilities to mimic 19th/early 20th century ferry dock facilities (with reproductions of early-period street furniture and appurtenances) and use of wrought iron, aged wood, and similar material that hide, screen, enclose or envelop the modern boat loading and other mechanical apparatus.
- Design traffic flows and access routes to remove existing traffic conflict with entrances to the Park.
- Select Options that require less large-scale earth moving and/or require less large-scale construction of wing-walls, jetties, retaining walls/sea walls, etc.

Aquatic Resources

Methodology and Assumptions

This aquatic resources analysis considers the following factors:

- Impacts from dredging in terms of surface area
- Impacts from pile driving in terms of number and size of pilings
- Shading impacts from increases in over-water cover
- Impacts to threatened and endangered species
- Impacts to “Essential Fish Habitat”
- Degree of difficulty to obtain permits (and cost of mitigation).

The discussion below describes how these factors were applied to analyze the harbor/vessel options and the assumptions made in applying those factors.

Dredging Impacts

Dredging removes all of the animals that are either immobile or too slow to escape, leaving the affected area devoid of food for fish and the larger mobile invertebrates such as shrimp and crabs. While recovery of some components of the ecosystem, such as macroalgae (kelp) and small invertebrates such as benthic copepods can be expected to recover in about a year, the larger longer-living non-mobile invertebrates recover to maturity over a longer period of time (3 to 5 plus years). Currently, the U.S. Army Corps of Engineers dredges the harbor every 5 to 6 years. While there is no precise way to quantify impacts in terms of lost ecological function, relative losses in terms of surface area disturbed is assumed to be a reasonable surrogate. Dredging footprints were calculated using CADD. The magnitude of impact is based on professional judgment.

Pile-Driving Impacts

Pile-driving produces sound pressure waves in both air and water. These forces can be powerful enough in water to kill or injure fish. The larger the piling diameter, the larger the force to drive the piling, resulting in larger pressure waves generated. Recent research has shown when hollow steel pilings are 14 inches or greater in diameter and are driven with an impact hammer fish closer than 100 feet can be harmed. The pilings that would be used at Keystone range from 24 to 72 inches in diameter, with most in the 24- to 30-inch range. Preliminary designs were made in which piling numbers and sizes were determined. It is assumed that relative impacts can be assessed based on the number and size of pilings

needed for the various alternatives. The magnitude of impact is based on professional judgment.

Shading Impacts

Over-water structures shade the seafloor resulting in a loss of primary productivity. This also translates into a loss of energy flow through the benthic community in the footprint of the shaded area. It is not practical to attempt assessing the impacts in a quantitative manner so a qualitative assessment was made using relative increases in over-water cover of the various alternatives. The magnitude of impact is based on professional judgment.

Threatened and Endangered Species

This assessment is based on potential dredging and pile-driving impacts to chinook salmon, bull trout, bald eagles, and marbled murrelets. Thus, this evaluation is a combination of the preceding evaluation categories and applied to these specific species. The magnitude of impact is based on professional judgment.

Impacts to Essential Fish Habitat

Impacts to essential fish habitat are those aspects of the project design which temporarily or permanently alter the character of the seafloor. Dredging temporarily alters the seafloor, but it also permanently alters the seafloor when steeper shoreline slopes are created. It is assumed that dredging will not alter the grain size of the substrate. Fill is a permanent impact to EFH if it changes the grain size of the seafloor surface. A sand bottom transformed with a riprap cover is an impact. The magnitude of impact is based on professional judgment.

Difficulty in Permitting

This assessment was made purely on the basis of professional judgement. The author has over 20 years of preparing NEPA and SEPA environmental documents and preparing state and federal permit applications in marine environments. He has prepared biological impact analyses in over 50 environmental assessments (EAs) and environmental impact statements (EISs) as well as over 30 biological assessments (BAs). In doing so, he has had the opportunity to discuss environmental impact significance, mitigation requirements, and impact avoidance strategies with a wide range of state and federal regulatory agency representatives.

Results

Dredging Impacts

- Moderate to High: The 130 and 100 sub-options of Options 2 and 4 would require 8.7 acres of dredging. Under Option 7, 9.2 acres would be dredged and the jetty relocated. The jetty's reef community could take 5 to 10 years to fully recover.
- Low: Option 6 would require dredging 1.1 acres or less.
- Least: Options 1, 3, and 5, as well as sub-options SE-2, KS-2, and NP-2 would not require dredging.

Pile Driving Impacts

All options with pile driving have potentially substantial impacts from sound pressure waves. The pilings that would be used are relatively large in diameter which would produce high-intensity sound pressure levels even with attenuation techniques such as bubble curtains.

- High: Option 3 sub-options with the batter-pile current deflector would have 318 pilings. Option 3 sub-options with the rock rubble mound current deflector would have 198 pilings. Options 2, 4, and 5 with the batter-pile current deflector, and Option 6 would have 228 to 238 pilings.
- Moderately High: Sub-option NP-5 would have 118 pilings. Options 1 and 7 would use 108 pilings. Sub-options of Options 2, 4 and 5 with the rock rubble mound current deflector have 108 and 118 pilings, respectively.

Shading Impacts

All of the options would have relatively minor impacts to the marine ecosystem due to over-water cover (shading).

- Low: Over-water coverage would increase as follows: Options 3 (0.4 acre), 4 (0.1 acre), and 5 (0.2 acre).
- Least: Options 1, 2, 6, and 7 would not increase over water coverage or shading.

Impacts to Threatened and Endangered Species

Impacts to these species are proportional to the impacts resulting primarily from pile driving but also include dredging and fill in the case of the rock rubble mound current deflector sub-options.

- Very High: Options 2, 4, 6 and 7.
- High: Options 3 and 5, all have potentially substantial impacts to threatened and endangered species (chinook salmon and marbled murrelets).
- Moderately High: Option 1 has the potential to impact T&E species from pile driving when the existing trestle is replaced.

Impacts to Essential Fish Habitat

Impacts to EFH is directly proportional to dredging (a temporary impact), the number of pilings (changes the bottom character), and any fill.

- High: All sub-options with the rock rubble mound current deflector.
- Moderate: Option 7; Option 4 sub-options without rock rubble mound current deflector; and 130-2 and 100-2 with the batter-pile wave barrier.
- Low: Options 1, 6, and NP-2, as well as Options 3 and 5, and sub-options SE-2 and KS-2 with the batter-pile wave barrier.

Difficulty in Permitting

Dredging, fill, and pile driving will receive intense scrutiny from the resource agencies. The alternatives that require the least of these activities would presumably require less mitigation and permit conditions, if not direct opposition.

- Very High: Sub-options 130-6, 100-6, and NP-6 are probably fatally flawed due to the extensive placement of sheet piles in the intertidal zone. (Vertical bulkheads are strongly discouraged by WDFW, USFWS, and NOAA Fisheries.)
- High: All sub-options with the rock rubble mound current deflector; Option 7 and NP-4; and sub-options 130 and 100 for Options 2 and 4 with the battered pile wave barrier.
- Moderate to High: All sub-options of Options 3 and 5, as well as SE-2, KS-2, SE-4, and KS-4 with the battered pile wave barrier; and NP-2, SE-6, and KS-6.
- Least: Option 1.

Combined Results

The summary of impacts for the various options is the same as described for difficulty in permitting. Basically, all of the build options would include pile driving that could create substantial temporary impacts during construction from sound pressure waves. Pile driving effects may be avoided or greatly minimized by using new technology or techniques in the future. Options with large dredge footprints would also cause considerable temporary impacts. Sheet pile bulkheads create poor shoreline habitat conditions.

- Very High: Sub-options 130-6, 100-6, and NP-6 are probably fatally flawed due to the extensive placement of sheet piles in the intertidal zone. (Vertical bulkheads are strongly discouraged by WDFW, USFWS, and NOAA Fisheries.)
- High: All sub-options with the rock rubble mound current deflector; Option 7 and NP-4; and sub-options 130 and 100 for Options 2 and 4 with the battered pile wave barrier.
- Moderate to High: All sub-options of options 3 and 5, as well as SE-2, KS-2, SE-4, and KS-4 with the battered pile wave barrier; and NP-2, SE-6, and KS-6.
- Least: Option 1.

Water Resources

Methodology and Assumptions

The water resources analysis for the Keystone Legislative Study considers three factors: impervious surface area and stormwater runoff treatment; effects to the water table; and marine water quality. The following discussion describes how these factors were applied to analyze the seven harbor/vessel options and the assumptions made in applying those factors.

Impervious Surface Area and Stormwater Runoff Treatment

Impervious surface area is the primary driver for stormwater runoff from a project site. Due to the concentrated nature of the automobile activity, the ferry car holding area will generate polluted runoff, particularly sediment, oils and some heavy metals. This analysis was carried out under the assumption that the project will provide stormwater treatment to all project runoff sufficient to meet the guidelines of the *Stormwater Management Manual for Western Washington* (Department of Ecology 2001, also known as the Ecology Manual) and the current version of the WSDOT *Highway Runoff Manual*. Specifically, it is assumed that all runoff will receive enhanced water quality treatment which is typically required for commercial parking lots. (From a stormwater runoff point of view, the ferry-car holding area will act as a commercial parking lot). Since this project will discharge directly to tidewater, no stormwater detention will be required per the Ecology Manual.

Since the project stormwater quality treatment will be provided to greatly reduce pollutants, none of the alternatives would result in serious water quality impacts to the nearby marine waters. The analysis is based primarily upon number of acres of impervious surface area covered by each alternative. However, the weighing in this analysis favors alternatives located at the existing car holding area. This area currently does not receive formal water quality treatment. Therefore the existing conditions results in the poorest runoff water quality and the project would result in a net improvement in local water quality conditions.

This analysis does not take into account that some *existing* impervious surface may be removed and restored as part of the project.

Water Table Impact

All of the alternatives lie adjacent to Puget Sound, only a few feet above sea level. Although there are no local groundwater data at the project site, given the topography and geology, it is likely that infiltrating rainfall tends to flow the relatively short distance directly to Puget Sound.

The addition of new impervious surface area would reduce recharge to the local groundwater, causing very small declines in the water table directly beneath the impervious surface. However, because of the high infiltration capacity of the very sandy beach deposit soils (USGS 2004) and the shallow depth to groundwater (most likely less than 5 feet), the small declines in the water table would extend less than 100 feet from the downgradient edge of the impervious surface. If native vegetation exists within this area of influence, it could be impacted.

The analysis highlights new areas of impervious surface area, particularly the ferry-car holding areas, since the limited groundwater declines would be closely associated with such.

Marine Water Quality

The water quality of the runoff from the ferry terminal is taken into account under “Impervious Surface Area and Stormwater Runoff Treatment” and is therefore not considered here. The analysis focuses upon the amount of marine bottom disturbance and associated water quality decline. It is also assumed that during construction, the project will implement best management practices for the protection of water quality and the

prevention of soil erosion. All impacts would be short-term, associated with construction, primarily dredging. This does not take into consideration possible water quality improvements resulting from changes to the harbor, such as widening the harbor mouth.

It was assumed that irrespective of the option selected, maintenance dredging would be continued to keep Keystone Harbor from silting over and to maintain the existing outlet from Crockett Lake. The marine water quality impacts associated with periodic maintenance dredging over the long-term would be the same for all options and was not factored into this analysis.

Results

The following summarizes how each vessel/harbor option performs relative to each factor for this water quality analysis. Specific effects of each vessel/harbor option are presented in the table in Attachment 1.

Impervious Surface Area/Runoff Treatment

- Moderate: Options 4 and 5 have the largest amounts of new impervious surface area.
- Low: Option 3 is sited over an existing parking area and creates a modest amount of new impervious surface area.
- Least: Options 1, 2, 6, and 7 are sited over an existing parking area and create the least amounts of new impervious surface area.

Water Table Impact

- Moderate: Option 4 could cause a minor decline in the water table; native vegetation could also be impacted.
- Low: Options 3 and 5 could also cause a minor decline in the water table but little or no impact to native vegetation is expected.
- Least: Options 1, 2, 6, and 7 would likely result in little or no decline in the water table and not impact to native vegetation is expected.

Marine Water Quality

- Moderate: Option 7, all 130 and 100 sub-options for Options 2, 4, and 6, as well as NP-4 and NP-6 would result in short-term impacts due to dredging.
- Low: All SE and KS sub-options for Options 4 and 6 would result in short-term impacts due to limited dredging.
- Least: Options 1, 3 and 5 and sub-options SE-2, KS-2, and NP-2 would result in minor short-term impact due to pile driving only.

Combined Results

Each of the three water resource factors was given equal weight in developing this overall assessment. Options 1 and 3 have the lowest water resources impact. Options 2, 6 and 7 have moderate impacts on one of the water resources factors, but are the preferred options

for other factors. Option 5 has moderate impacts. The option with the highest water resource impact is Option 4. This option would have moderate impacts across all of the water resource factors.

With regard to water resources, none of the options were found to have high impact. None have a potentially fatal flaw which would lead to eliminating it from further consideration. All of the marine water quality impacts would be short-term, occurring only during construction.

References

U.S. Geological Survey, 2004. *Estimating Ground-Water Recharge from Precipitation on Whidbey and Camano Islands, Island County, Washington, Water Years 1998 and 1999*. Water-Resources Investigation Report 03-4101.

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ATTACHMENT 1

Environmental Considerations Table

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria	1. No-Build Alternative			2. Existing Slip with Jetty Extension								
				SE-2		130-2		100-2		KS-2		NP-2
	SE-1	KS-1	NP-1	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	
Parks & Recreation												
Fort Casey State Park												
Area of Acquisition	0.4 acre acquired southwest of existing holding area/used for expanded holding area	Same as SE-1	Same as SE-1 and KS-1	No acquisition of existing campground area 0.4 acre acquired southwest of existing holding area/used for expanded holding area	Same as battered pile Same as battered pile	2.2 acres of existing campground area acquired/area dredged to widen channel Same as SE-2	Same as battered pile	Same as 130-2 Same as SE-2	Same as battered pile	Same as SE-2 Same as SE-2	Same as battered pile	Same as SE-2 and KS-2 Same as SE-2 and KS-2
Specific Facility(ies) Affected	No facilities affected	Same as SE-1	Same as SE-1 and KS-1	No facilities affected	Same as battered pile	9 campsites within acquired area would be displaced	Same as battered pile	Same as 130-2	Same as battered pile	Same as SE-2	Same as battered pile	Same as SE-2 and KS-2
Other Effects	Would require minor relocation of entrance roadway from main area of park into campground	Same as SE-1	Same as SE-1 and KS-1	Would require minor relocation of entrance roadway from main area of park into campground	Same as battered pile	East leg of campground loop and restrooms would need to be relocated/could result in the displacement of additional campsites Would require minor relocation of entrance roadway from main area of park into campground	Same as battered pile	Same as 130-2	Same as battered pile	Same as SE-2	Same as battered pile	Same as SE-2 and KS-2
Keystone Conservation Area												
Area of Acquisition	No acquisition required	Same as SE-1	Same as SE-1 and KS-1	No acquisition required	Same as SE-2 (battered pile)	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2 and KS-2
Other Effects	No other effects	Same as SE-1	Same as SE-1 and KS-1	During construction of the current deflector, the area would likely be closed to divers for safety reasons	Same as SE-2 (battered pile)	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2 and KS-2

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria												
	1. No-Build Alternative			2. Existing Slip with Jetty Extension								
	SE-1	KS-1	NP-1	SE-2		130-2		100-2		KS-2		
				Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile
Cultural and Historic Resources												
Volume (cubic meters) of sediment (earth/rock/sand, etc.) to be excavated	No dredging	No dredging	No dredging	No dredging	Same as battered pile	73,587 cubic yards	Same as battered pile	73,587 cubic yards	Same as battered pile	No dredging	Same as battered pile	No dredging
Presence/absence of known/recorded historic properties (archaeological sites and/or historic structures)	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains
Surface area (acres) of presently undisturbed land affected by Project footprint	None	None	None	None	Same as battered pile	8.7 acres	Same as battered pile	8.7 acres	Same as battered pile	None	Same as battered pile	None
Aquatic Resources												
Dredging impacts (acres)	None	None	None	None	None	Major dredging impacts (8.7 acres)	Same as 130-2 (battered pile)	Major dredging impacts (8.7 acres)	Same as 100-2 (battered pile)	None	None	None
Dredging impacts by volume (cubic yards)	None	None	None	None	None	73,587 CY	Same as 130-2 (battered pile)	73,587 CY	Same as 100-2 (battered pile)	None	None	None
Impacts from pile driving (number and size)	Potentially major impacts from pile driving (108 piles, 24 to 36-inch)	Potentially major impacts from pile driving (108 piles, 24 to 36-inch)	Potentially major impacts from pile driving (108 piles, 24 to 36-inch)	Potentially major impacts from pile driving (228 piles, 120 of which are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, 120 of which are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, 120 of which are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, 120 of which are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, 24 to 36-inch))
Increased over-water cover (acres)	None	None	None	None	None	None	None	None	None	None	None	None
Impacts to T&E species	Moderatly high	Moderatly high	Moderatly high	High: Potential impacts that will lead to formal consultation	Same as SE-2 (battered pile)	Very High: Potential impacts that will lead to formal consultation	Same as 130-2 (battered pile)	Very High: Potential impacts that will lead to formal consultation	Same as 100-2 (battered pile)	High: Potential impacts that will lead to formal consultation	Same as KS-2 (battered pile)	Moderatly high, but lowest for alt.2
Impacts to EFH (dredge and /or riprap fill)	Minor	Minor	Minor	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Moderate due to dredging	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Moderate due to dredging	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor
Permitability	Least difficult	Least difficult	Least difficult	Moderately difficult	Very difficult	Difficult	Very difficult	Difficult	Very difficult	Moderately difficult	Very difficult	Moderately difficult
Water Resources												
Impervious Area (IA)/Runoff Treatment	2.4 acres. Minor increase in IA. Water quality treatment would be provided where no treatment currently occurs.	Same as SE-1	Same as SE-1	2.4 acres. Minor increase in IA. Water quality treatment would be provided where no treatment currently occurs.	Same as SE-2 (battered pile)	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2
Water Table Impact	New parking area located at existing parking area and adjacent to saltwater. No change in water table conditions. Minimal effect on native vegetation.	Same as SE-1	Same as SE-1	New parking area located at existing parking area and adjacent to saltwater. No change in water table conditions. Minimal effect on native vegetation.	Same as SE-2 (battered pile)	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2
Marine Water Quality	Pile driving, only (no dredging). Very limited areas of water quality impact.	Same as SE-1	Same as SE-1	Pile driving, only (no dredging). Very limited areas of water quality impact.	Relatively large area affected by rock placement. Temporary water quality impacts due sediment suspension.	Relatively large area of dredging. Temporary water quality impacts.	Same as SE-2	Same as 130-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria										
	3. Harbor Mouth Slip East State Park Terminal									
	SE-3		130-3		100-3		KS-3		NP-3	
	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound
Parks & Recreation										
Fort Casey State Park										
Area of Acquisition	3.3 acres within boat launch trailer parking area/dive area parking area acquired	Same as battered pile	Same as SE-3	Same as battered pile	Same as SE-3	Same as battered pile	Same as SE-3	Same as battered pile	Same as SE-3 and KS-3	Same as battered pile
Specific Facility(ies) Affected	Boat launch and trailer parking would be displaced/these facilities would be relocated to area currently used for WSF purposes (existing terminal and holding area)	Same as battered pile	Same as SE-3	Same as battered pile	Same as SE-3 and 130-3	Same as battered pile	Same as SE-3	Same as battered pile	Same as SE-3 and KS-3	Same as battered pile
Other Effects	Area currently used for WSF purposes could be returned to park use/enable State Parks to consolidate camping, boating and other recreational activities within harbor/less conflict with ferry operations	Same as battered pile	Same as SE-3	Same as battered pile	Same as SE-3 and 130-3	Same as battered pile	Same as SE-3	Same as battered pile	Same as SE-3 and KS-3	Same as battered pile
Keystone Conservation Area										
Area of Acquisition	0.8 acre of upland area acquired to accommodate terminal footprint	Same as SE-3 (battered pile)	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3 and KS-3	Same as SE-3 and KS-3
Other Effects	Alternative access and parking area would be required east of proposed holding area/more circuitous access to break water from upland dive staging area During construction of the current deflector, the area would likely be closed to divers for safety reasons	Same as SE-3 (battered pile)	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3 and KS-3	Same as SE-3 and KS-3

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria	3. Harbor Mouth Slip East State Park Terminal									
	SE-3		130-3		100-3		KS-3		NP-3	
	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound
Cultural and Historic Resources										
Volume (cubic meters) of sediment (earth/rock/sand, etc.) to be excavated	No dredging	Same as battered pile	No dredging	Same as battered pile	No dredging	Same as battered pile	No dredging	Same as battered pile	No dredging	Same as battered pile
Presence/absence of known/recorded historic properties (archaeological sites and/or historic structures)	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile
Surface area (acres) of presently undisturbed land affected by Project footprint	None	Same as battered pile	None	Same as battered pile	None	Same as battered pile	None	Same as battered pile	None	Same as battered pile
Aquatic Resources										
Dredging impacts (acres)	None	None	None	None	None	None	None	None	None	None
Dredging impacts by volume (cubic yards)	None	None	None	None	None	None	None	None	None	None
Impacts from pile driving (number and size)	Potentially major impacts from pile driving (318 piles, of which 120 are 78-inch)	Potentially major impacts (198 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (318 piles, of which 120 are 78-inch)	Potentially major impacts (198 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (318 piles, of which 120 are 78-inch)	Potentially major impacts (198 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (318 piles, of which 120 are 78-inch)	Potentially major impacts (198 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (318 piles, of which 120 are 78-inch)	Potentially major impacts (198 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)
Increased over-water cover (acres)	0.4 acre	0.4 acre	0.4 acre	0.4 acre	0.4 acre	0.4 acre	0.4 acre	0.4 acre	0.4 acre	0.4 acre
Impacts to T&E species	High: Potential impacts that will lead to formal consultation	Same as SE-3 (battered pile)	High: Potential impacts that will lead to formal consultation	Same as 130-3 (battered pile)	High: Potential impacts that will lead to formal consultation	Same 100-3 (battered pile)	High: Potential impacts that will lead to formal consultation	Same as KS-3 (battered pile)	Moderatly high, but lowest for alt.3	Same as NP-3 (battered pile)
Impacts to EFH (dredge and /or riprap fill)	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater
Permitability	Moderately difficult	Very difficult	Moderately difficult	Very difficult	Moderately difficult	Very difficult	Moderately difficult	Very difficult	Moderately difficult	Very difficult
Water Resources										
Impervious Area (IA)/Runoff Treatment	4.5 acres; covers the existing recreation parking area.	Same as SE-3 (battered pile)	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3
Water Table Impact	Minor additional loss of infiltration adjacent to a natural area	Same as SE-3 (battered pile)	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3	Same as SE-3
Marine Water Quality	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria									
	4. In-Harbor Slip State Park Terminal								
	SE-4		130-4		100-4		KS-4		NP-4
	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	
Parks & Recreation									
Fort Casey State Park									
Area of Acquisition	No acquisition of existing campground area	Same as battered pile	1.3 acres of existing campground area acquired/area dredged to widen channel	Same as battered pile	Same as 130-4	Same as battered pile	Same as SE-4	Same as battered pile	Same as 130-4 and 100-4
	5.3 acres, acquired within area northeast of harbor (northeast corner of existing boat launch parking area and undeveloped area farther east)		Same as SE-4		Same as SE-4	Same as battered pile	Same as SE-4	Same as battered pile	Same as SE-4
Specific Facility(ies) Affected	Northeast corner (±20%) of boat launch parking area would be used/access to boat launch made more difficult/these facilities would be relocated to area currently used for WSF purposes (existing terminal and holding area)	Same as battered pile	Same as SE-4	Same as battered pile	Same as SE-4	Same as battered pile	Same as SE-4	Same as battered pile	Same as SE-4 and KS-4
	No facilities affected		4 campsites within acquired area would be displaced		Same as 130-4	Same as battered pile	Same as SE-4	Same as battered pile	Same as 130-4 and 100-4
Other Effects	Area currently used for WSF purposes could be returned to park use/enable State Parks to consolidate camping, boating, and other recreational activities within harbor/less conflict with ferry operations	Same as battered pile	Same as SE-4	Same as battered pile	Same as SE-4	Same as battered pile	Same as SE-4	Same as battered pile	Same as SE-4 and KS-4
			East leg of campground loop would need to be relocated/could result in the displacement of additional campsites	Same as battered pile	Same as 130-4	Same as battered pile			Same as 130-4 and 100-4
Keystone Conservation Area									
Area of Acquisition	No acquisition required	Same as SE-4 (battered pile)	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as KS-4 (battered pile)	Same as SE-4 and KS-4
Other Effects	Access would be made more difficult/new access would be required (possibly along waterside of proposed holding area)	Same as SE-4 (battered pile)	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as KS-4 (battered pile)	Same as SE-4 and KS-4
	During construction of the current deflector, the area would likely be closed to divers for safety reasons	Same as SE-4 (battered pile)							

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria									
	4. In-Harbor Slip State Park Terminal								
	SE-4		130-4		100-4		KS-4		NP-4
	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	
Cultural and Historic Resources									
Volume (cubic meters) of sediment (earth/rock/sand, etc.) to be excavated	8,464 cubic yards	Same as battered pile	84,508 cubic yards	Same as battered pile	84,508 cubic yards	Same as battered pile	8,464 cubic yards	Same as battered pile	84,508 cubic yards
Presence/absence of known/recorded historic properties (archaeological sites and/or historic structures)	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains
Surface area (acres) of presently undisturbed land affected by Project footprint	0.5 acre	Same as battered pile	8.1 acres	Same as battered pile	8.1 acres	Same as battered pile	0.5 acre	Same as battered pile	8.1 acres
Aquatic Resources									
Dredging impacts (acres)	Minor dredging impacts (0.5 acre)	Same as SE-4 (battered pile)	Major dredging impacts (8.1 acres)	Same as 130-4 (battered pile)	Major dredging impacts (8.1 acres)	Same as 100-4 (battered pile)	Minor dredging impacts (0.5 acre)	Same as KS-4 (battered pile)	Major dredging impacts (8.1 acres)
Dredging impacts by volume (cubic yards)	8,464 CY	Same as SE-4 (battered pile)	84,508 CY	Same as 130-4 (battered pile)	84,508 CY	Same as 100-4 (battered pile)	8,464 CY	Same as KS-4 (battered pile)	84,508 CY
Impacts from pile driving (number and size)	Potentially major impacts from pile driving (228 piles, of which 120 are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, of which 120 are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, of which 120 are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, of which 120 are 78-inch)	Potentially major impacts (108 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (228 piles, of which 120 are 78-inch)
Increased over-water cover (acres)	0.1 acre	0.1 acre	0.1 acre	0.1 acre	0.1 acre	0.1 acre	0.1 acre	0.1 acre	0.1 acre
Impacts to T&E species	Very High: Potential impacts that will lead to formal consultation	Same as SE-4 (battered pile)	Very High: Potential impacts that will lead to formal consultation	Same as 130-4 (battered pile)	Very High: Potential impacts that will lead to formal consultation	Same as 100-4 (battered pile)	Very High: Potential impacts that will lead to formal consultation	Same as KS-4 (battered pile)	Very High: Potential impacts that will lead to formal consultation
Impacts to EFH (dredge and /or riprap fill)	Moderate due to dredging	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Moderate due to dredging	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Moderate due to dredging	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Moderate due to dredging	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Moderate due to dredging
Permitability	Moderately difficult	Very difficult	Difficult	Very difficult	Difficult	Very difficult	Moderately difficult	Very difficult	Difficult
Water Resources									
Impervious Area (IA)/Runoff Treatment	5.0 acres. About two-thirds of the IA would be new.	Same as SE-4 (battered pile)	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4
Water Table Impact	Parking area is adjacent to undisturbed area; some impact to native vegetation is possible due to minor water table changes.	Same as SE-4 (battered pile)	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4	Same as SE-4
Marine Water Quality	Pile driving, with minor dredging. Limited areas of water quality impact.	Relatively large area affected by rock placement. Temporary water quality impacts due sediment suspension.	Relatively large area of dredging. Temporary water quality impacts.	Relatively large area affected by rock placement. Temporary water quality impacts due sediment suspension.	Same as 130-4	Same as 130-4	Same as SE-4	Same as SE-4	Same as 130-4

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Environmental Element/ Evaluation Criteria										
	5. West State Park Slip and Terminal									
	SE-5		130-5		100-5		KS-5		NP-5	
	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound
Parks & Recreation										
Fort Casey State Park										
Area of Acquisition	5.1 acres of existing campground area acquired/area would be used for proposed holding area and vehicle access road	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5 and KS-5	Same as battered pile
Specific Facility(ies) Affected	24 campsites and the restrooms within acquired area would be displaced/remaining 11 campsites at south end of campground may be inaccessible/unusable	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5 and KS-5	Same as battered pile
	Access to trails to and from campground would be more difficult	Same as battered pile								
Other Effects	Most of area currently used for WSF purposes (existing terminal and holding area) could be returned to park use/could be site for partial relocation of campsites (other potential relocation site could be east of boat launch parking area)	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5	Same as battered pile	Same as SE-5 and KS-5	Same as battered pile
Keystone Conservation Area										
Area of Acquisition	No acquisition required	Same as SE-5 (battered pile)	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5 and KS-5	Same as SE-5 and KS-5
Other Effects	During construction of the current deflector, the area would likely be closed to divers for safety reasons	Same as SE-5 (battered pile)	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5 and KS-5	Same as SE-5 and KS-5

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria	5. West State Park Slip and Terminal									
	SE-5		130-5		100-5		KS-5		NP-5	
	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound	Battered Pile	Rubble Mound
Cultural and Historic Resources										
Volume (cubic meters) of sediment (earth/rock/sand, etc.) to be excavated	No dredging	Same as battered pile	No dredging	Same as battered pile	No dredging	Same as battered pile	No dredging	Same as battered pile	No dredging	Same as battered pile
Presence/absence of known/recorded historic properties (archaeological sites and/or historic structures)	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	Same as battered pile
Surface area (acres) of presently undisturbed land affected by Project footprint	None	Same as battered pile	None	Same as battered pile	None	Same as battered pile	None	Same as battered pile	None	Same as battered pile
Aquatic Resources										
Dredging impacts (acres)	None	None	None	None	None	None	None	None	None	None
Dredging impacts by volume (cubic yards)	None	None	None	None	None	None	None	None	None	None
Impacts from pile driving (number and size)	Potentially major impacts from pile driving (238 piles, of which 120 are 78-inch)	Potentially major impacts (118 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (238 piles, of which 120 are 78-inch)	Potentially major impacts (118 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (238 piles, of which 120 are 78-inch)	Potentially major impacts (118 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (238 piles, of which 120 are 78-inch)	Potentially major impacts (118 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)	Potentially major impacts from pile driving (238 piles, of which 120 are 78-inch)	Potentially major impacts (118 piles, 24 to 36-inch), but less than with the battered pile (120 less 78-inch piles)
Increased over-water cover (acres)	0.2 acre	0.2 acre	0.2 acre	0.2 acre	0.2 acre	0.2 acre	0.2 acre	0.2 acre	0.2 acre	0.2 acre
Impacts to T&E species	High: Potential impacts that will lead to formal consultation	Same as SE-5 (battered pile)	High: Potential impacts that will lead to formal consultation	Same as 130-5 (battered pile)	High: Potential impacts that will lead to formal consultation	Same as 100-5 (battered pile)	High: Potential impacts that will lead to formal consultation	Same as KS-5 (battered pile)	High: Potential impacts that will lead to formal consultation	Same as NP-5 (battered pile)
Impacts to EFH (dredge and /or riprap fill)	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater	Minor	Major impacts to EFH due to placement of 5.1 acres of riprap fill for the extended breakwater
Permitability	Moderately difficult	Very difficult	Moderately difficult	Very difficult	Moderately difficult	Very difficult	Moderately difficult	Very difficult	Moderately difficult	Very difficult
Water Resources										
Impervious Area (IA)/Runoff Treatment	5.1 acres. Almost all IA would be new.	Same as SE-5 (battered pile)	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5
Water Table Impact	Minor water table decline due to new IA. Parking area located down-gradient of native vegetation. Therefore, no impact to native vegetation..	Same as SE-5 (battered pile)	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5	Same as SE-5
Marine Water Quality	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-5	Same as SE-2	Same as SE-5	Same as SE-2	Same as SE-2	Same as SE-2

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria							
	6. Existing Slip with Line Dolphins					7. Existing Slip with Jetty East	
	SE-6	130-6	100-6	KS-6	NP-6	130-7	100-7
Parks & Recreation							
Fort Casey State Park							
Area of Acquisition	0.4 acre acquired southwest of existing holding area/used for expanded holding area	Same as SE-6	Same as SE-6	Same as SE-6	Same as SE-6 and KS-6	1.6 acres in the vicinity of the boat launch/trailer parking area would be acquired within dredged area. 0.4 acre would be acquired southwest of existing holding area and used for expanded holding area.	Same as 130-7
Specific Facility(ies) Affected	No facilities affected	Loss of beach along east edge of campground with sheet pile wall Boat launch may need to be relocated, depending on extent of sheet pile wall on east side of harbor	Same as 130-6	Same as SE-6	Same as 130-6 and 100-6	Boat launch would be displaced and relocated farther east along edge of dredged area; southeast half of trailer parking area would be removed, along with up to six picnic tables.	Same as 130-7
Other Effects	Dolphins could patrially block view from shoreline Would require minor relocation of entrance roadway from main area of park into campground	Sheet pile wall may extend ± 15 feet above water line—combination of sheet pile wall and dolphins could create some degree of view blockage from the shoreline (both campground and Conservation Area) Area behind sheet pile wall could be back-filled to create expanded campground area/promenade Same as SE-6	Same as 130-6 Same as SE-6	Same as SE-6 Same as SE-6	Same as 130-6 and 100-6 Same as SE-6	Minor relocation of entrance roadway from main area of park into campground would be required.	Same as 130-7
Keystone Conservation Area							
Area of Acquisition	No acqisition required	Same as SE-6	Same as SE-6	Same as SE-6	Same as SE-6 and KS-6	0.4 acre of upland area would be acquired within dredged area.	Same as 130-7
Other Effects	During construction of the current deflector, the area would likely be closed to divers for safety reasons	Same as SE-6	Same as SE-6	Same as SE-6	Same as SE-6 and KS-6	Existing breakwater would be removed and relocated 300 feet to the east. Removal of the existing breakwater would eliminate established dive feature and diminish current dive experience. Recreating similar underwater conditions at relocated breakwater would take 5 to 10 years. Dive programs, classes, and general use would be adversely impacted during recovery period. During construction (dredging, removal, and relocation of breakwater), the area would likely be closed to divers for safety reasons.	Same as 130-7

Keystone Ferry Terminal Study Environmental Evaluation

Environmental Element/ Evaluation Criteria	6. Existing Slip with Line Dolphins					7. Existing Slip with Jetty East	
	SE-6	130-6	100-6	KS-6	NP-6	130-7	100-7
Cultural and Historic Resources							
Volume (cubic meters) of sediment (earth/rock/sand, etc.) to be excavated	3,050 cubic yards	14,104 cubic yards	14,104 cubic yards	3,050 cubic yards	14,104 cubic yards	179,734 cubic yards	179,734 cubic yards
Presence/absence of known/recorded historic properties (archaeological sites and/or historic structures)	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains	None known/recorded, but area has high probability for the presence of historic and prehistoric archaeological remains
Surface area (acres) of presently undisturbed land affected by Project footprint	0.2 acre	1.1 acres	1.1 acres	0.2 acre	1.1 acres	10.3 acres	10.3 acres
Aquatic Resources							
Dredging impacts (acres)	Minor dredging impacts (0.24 acre)	Moderate dredging impacts (1.1 acres)	Moderate dredging impacts (1.1 acres)	Minor dredging impacts (0.24 acre)	Moderate dredging impacts (1.1 acres)	Major dredging impacts (9.2 acres). Highest of any build alternative group. Has additional impacts due to the fill from the jetty relocation (1.0 acre).	Same as 130-7
Dredging impacts by volume (cubic yards)	3,050 CY	14,104 cubic yards	14,104 cubic yards	3,050 cubic yards	14,104 cubic yards	179,734 cubic yards	Same as 130-7
Impacts from pile driving (number and size)	Potentially major impacts from pile driving (232 piles 24 to 36-inch)	Potentially major impacts from pile driving (232 piles 24 to 36-inch plus 1425 feet of sheet pile wall)	Potentially major impacts from pile driving (232 piles 24 to 36-inch plus 1425 feet of sheet pile wall)	Potentially major impacts from pile driving (232 piles 24 to 36-inch)	Potentially major impacts from pile driving (232 piles 24 to 36-inch plus 1425 feet of sheet pile wall)	Potentially substantial impacts from pile driving (108 piles- 20 to 36 inch). Lowest of any build alternative group, however, due to lack of wave barrier.	Same as 130-7
Increased over-water cover (acres)	None	None	None	None	None	None	None
Impacts to T&E species	Very High: Potential impacts that will lead to formal consultation	Very High: Potential impacts that will lead to formal consultation	Very High: Potential impacts that will lead to formal consultation	Very High: Potential impacts that will lead to formal consultation	Very High: Potential impacts that will lead to formal consultation	Very High: Potential impacts that will lead to formal consultation	Same as 130-7
Impacts to EFH (dredge and /or riprap fill)	Minor	Minor	Minor	Minor	Minor	Moderate due to dredging and jetty relocation. Highest of any build alternative group.	Same as 130-7
Permitability	Moderately difficult	Unlikely to obtain permits for this alternative: The sheet pile wall is probably a fatal flaw	Unlikely to obtain permits for this alternative: The sheet pile wall is probably a fatal flaw	Moderately difficult	Unlikely to obtain permits for this alternative: The sheet pile wall is probably a fatal flaw	Difficult	Same as 130-7
Water Resources							
Impervious Area (IA)/Runoff Treatment	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	4.8 acres. Limited increase in IA. Water quality treatment would be provided where no treatment currently occurs.	Same as 130-7
Water Table Impact	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2	Same as SE-2
Marine Water Quality	Same as SE-4	Same as 130-4	Same as 130-4	Same as SE-4	Same as 130-4	Same as 130-2	Same as 130-2